Nationally Representative Household Level Food Consumption and Nutrient Availability Data for Ghana from 2005-2017

Francis Tsiboe. E-mail: ftsiboe@hotmail.com ORCID: 0000-0001-5984-1072

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Abstract

Reliable and comprehensive nationwide household-level consumption and expenditure data is crucial for tracking poverty, hunger, nutrition, and health/well-being outcomes. Such data can also provide an evidence-based road map on how these issues can be addressed from a policy standpoint. Data collected via the Living Standards Measurement Study (LSMS) provides Ghana with this avenue, yet the reports from them by the Ghana Statistical Service (GSS) neither consider the trends nor in-depth analysis of food consumption and nutrient availability beyond food expenditure. This paper sets the premise to fill this knowledge gap by harmonizing and generating nationally representative household-level food consumption and nutrient availability variables (price, quantities, and values) alongside consumption of non-food items and other household-level variables from the Ghana Living Standards Surveys (GLSS) fielded in 2005/06, 2012/13, and 2016/17. The harmonized data has the widest spatiotemporal and socioeconomic coverage of Ghanaian households. As such it presents a unique opportunity to empirically analyze key food consumption and nutrient availability phenomena at the household level.

Keywords – food consumption; Ghanaian households; non-food expenditure; nutrient availability; spatiotemporal trends

Repository for data and codes: https://github.com/ftsiboe/Household-Consumption-Expenditure-Ghana

1. Introduction

Reliable and detailed nationwide household consumption and expenditure data is a linchpin in monitoring progress towards reducing poverty, hunger, and enhancing nutritional and health outcomes. It equips us with essential insights to draft evidence-based policies aimed at addressing these issues. The Ghana Living Standards Surveys (GLSS) avails Ghana of such a valuable resource. However, the reports generated by the Ghana Statistical Service (GSS) and existing studies from these surveys have overlooked the crucial aspects of tracking trends and conducting a comprehensive analysis of food consumption and nutrient availability beyond food expenditure.

This paper endeavors to address this knowledge gap. We harmonize and generate nationally representative data on household-level food consumption and nutrient availability (price, quantities, and values) alongside non-food consumption and other household variables from the GLSS conducted in 2005/06, 2012/13, and 2016/17. This harmonized dataset provides the broadest spatiotemporal and socioeconomic coverage of Ghanaian households to date, making it a uniquely

powerful tool for empirical analysis of critical food consumption and nutrient availability patterns at the household level. The dataset encompasses 37,686 households, representing approximately 85% of Ghana's population as of 2017, approximating to about 24.67 million Ghanaians. Each household's data includes between one to eight weekly observed consumption records for 51 food and non-food items. This data can be cross-linked with other sections of the GLSS for econometric analyses relating food and non-food consumption to various socioeconomic outcomes.

The potential of this dataset to inform future policy interventions is highlighted in a descriptive empirical application that evaluates changes in the consumption of major food groups and nutrient availability. The application paints a picture of dietary patterns in Ghana that is changing, with traditional staples like cereals still playing a dominant role but other food groups contributing to a more diverse diet. This corresponds with the concept of a nutrition transition, where diets diversify and incorporate a wider array of foods as incomes increase and food environments change. The data further demonstrates the ongoing nutrition transition in Ghana, characterized by significant increases in nutrient availability over time. However, it also highlights the need for targeted interventions to address regional and socioeconomic disparities in nutrient access and intake. The rate of this transition and its implications for public health in Ghana would require further examination, emphasizing the importance of understanding the changing dietary landscape and developing strategies to ensure equitable access to a diverse and nutritious diet for all segments of the population.

Notwithstanding the exemplified application, the data can be utilized for a host of applications such as a demand system analysis of food and non-food items, serving as benchmark values for ex-ante type analyses, and crucially, for informing policy decisions regarding nutrition and food security in Ghana. By putting this data into practice, we hope to make strides in enhancing living standards across the nation.

2. Construction of the database

This study primarily utilizes household-level data obtained from population-based surveys conducted in Ghana at approximately five-year intervals. This data is supplemented with price information sourced from national and private institutions.

The Ghana Living Standards Surveys (GLSS) serves as Ghana's local adaptation of the Living Standards Measurement Study initiated by the World Bank's Policy Research Division in 1980. As a tool to understand socio-economic conditions, the GLSS provides nationally representative data that aids policymakers in assessing socio-economic indicators and understanding Ghana's living conditions. Since the initial survey in 1987/88 (GLSS1), six more have been conducted in 1988/89 (GLSS2), 1991/92 (GLSS3), 1998/99 (GLSS4), 2005/06 (GLSS5), 2012/13 (GLSS6), and 2016/17 (GLSS7). These raw data, encompassing all regions, are publicly accessible via the Ghana Statistical Service (GSS) National Data Archive (NADA).

The GLSS datasets were structured to provide both regional and national level samples using a two-stage stratified sampling design. Firstly, Enumeration Areas (EA) were chosen as the primary sampling units (PSU), allocated to Ghana's ten regions proportionally to their population sizes. A list of households in these PSUs was then compiled to create the secondary sampling units (SSUs). The second sampling stage involved systematically selecting 15 households from each PSU, resulting in a total inclusion of households and household members that varied from GLSS1 to GLSS7. Detailed information on the surveys' sampling and data collection methods is available in the documentation published with the data at NADA. The harmonized data utilized in this study

is confined to households sampled in GLSS5, GLSS6, and GLSS7 due to the lack of reliable price data for surveys conducted before 2005.

GLSS survey instruments across the various waves exhibit a similar structure and content. The most recent wave (GLSS7) will serve as the primary focus hereafter. The GLSS7 instrument consisted of multiple questionnaires on household, non-farm enterprise, governance, peace and security, community, and prices of food and non-food items. The data generated by this study utilized information from the household, community, and price questionnaires. The household questionnaire was divided into two parts, A and B, with A covering demographics, education, health, employment, time use, migration, tourism, agricultural production holdings, and housing, and B containing information on household agriculture, income, expenditure, income transfers, migration, remittances, and financial services. The community questionnaire captured data on community facilities and services, while the price questionnaire collected data on commodity prices in major community markets.

2.1 Household demographics

Generally, household members' demographics were extracted from the household roster (SEC1). However, to ensure sensible harmonization across all GLSS waves, characteristics like educational level, marital status, relationship to the household head, ethnicity, and religion were consolidated into fewer groups. The size of the household in adult male equivalence (AE) was determined based on the demographics of its members. This was calculated by dividing the total energy requirements of the household by 2,250 kcal, the energy requirement of an adult male aged 19 to 50 years. This calorie-based scale, as proposed by the National Academy of Sciences-National Research Council (National Academy of Sciences-National Research Council [NRC] 1989), is frequently used in Ghanaian studies (Tsiboe et al. 2018) to quantify household size, as it accounts for variations in energy requirements across different ages and genders. The AE framework was also employed to categorize household members into different age groups: infants (under one year), toddlers (1 to 3 years), children (4 to 11 years), teenagers (12 to 17 years), young adults (18 to 34 years), mid-age adults (36 to 55 years), old adults (56 to 70 years), and very old adults (above 70 years). Utilizing these categories, the household dependency ratio was computed as the total AE for members aged 18 to 70 years divided by that for members aged under 18 years or above 70 years.

The literature on intra-household bargaining (Doss 2013; Quisumbing 2003) suggests that resource allocation correlates positively with the relative bargaining power of household members. Therefore, when analyzing household consumption outcomes, it is essential to include the characteristics of those members who make purchasing and cooking decisions. The GLSS identifies these decision-makers in SEC6, and this study constructs a representative profile for them, capturing their size (number of deciders in adult equivalence), gender (ratio of female deciders), headship (ratio of deciders designated as the household head), age (mean age per adult equivalence), education (mean years of education per adult equivalence), and employment status (ratio of deciders employed).

Besides these variables, the study also assessed household poverty and welfare levels using existing living standard measures previously calculated for each GLSS by the Ghana Statistical Service (GSS). These measures helped classify households as very poor, poor, or non-poor based on an appropriate poverty line calculated for each GLSS by GSS. Other household variables constructed from existing GSS-generated data included household income (income from all

sources per adult equivalence of household members) and a rural indicator, which denotes if the household is in a locality classified by the survey team as a rural area.

2.2 Consumption value

In line with this study's objective, the consumption and expenditure data extracted was restricted to education expenses (SEC2A), housing expenses (SEC7C), utility and amenity expenses (SEC7D), consumption of home produce (SEC8H), expenditure on less frequent non-food items (SEC9A), expenditure on frequent items (SEC9B), and other miscellaneous expenses (SEC11D).

Although the GLSS surveys are conducted repeatedly, they do not form a continuous panel of households due to the sampling of new households each time. These surveys, however, span a duration of 12 months, enabling the tracking of household consumption and expenditures. Information related to household consumption from own production and expenditure on frequently purchased items is gathered 7 to 11 times at 3 to 5-day intervals within a 33-to-35-day cycle. [1] Utilizing this data, the study creates a detailed representative household consumption value for each item in a typical week. This value—representing the total value of purchases added to the value of consumed own production—is established over the dates of the interview in two steps. Each item's weekly household consumption value is computed by dividing the total consumption value (in GHC/AE) recorded by the survey by the total number of implied recall days from the survey, and then multiplying by seven days.

In contrast to own produce consumption and expenses on frequently purchased items, expenses on less frequently purchased non-food items are reported only once during the 5th visit over a 12-month recall period. The study converts the consumption value of these items to a weekly scale by dividing reported values by 52. The retained items include electricity, firewood, charcoal, liquefied petroleum gas (LPG), diesel, petrol, and kerosene, along with items classified as communication, transportation, education, recreation, or health. During the 1st visit, individual-level data on educational expenditure is collected. These expenses, recorded over a 12-month recall period, are aggregated, and then divided by 52 to obtain the total weekly education expenditure. Household expenditures for utilities and amenities such as electricity, water, toilet, and garbage/sewage disposal are reported over specified periods (e.g., daily, weekly, or annual). These are converted to a weekly time scale using appropriate multipliers. Household rent payments reported over specified periods are similarly converted to a weekly time scale. For households who did not pay, or report rent, the study extrapolates their implied weekly rent based on reported rent from households with similar housing characteristics.

Expenditure on electricity is reported in both expenses on utilities and amenities in SEC7D ($\text{Electricity}_{sec7d}$) and as part of the less frequently purchased non-food items in SEC9A ($\text{Electricity}_{sec9a}$). As there are no specifications in the survey instrument suggesting that expenditure from these sections is mutually exclusive or inclusive, the study takes a prudent approach by adding them together to construct the consumption value for electricity (i.e.,

[1] For GLSS5 the survey team visited 15 households in each EA 11 times at 3-day intervals to make 33-day cycle. For GLSS6 and GLSS7 the survey team visited 15 households in each EA 7 times at 5-day intervals to make 35-day cycle.

Electricity $_{sec7d}$ + Electricity $_{sec9a}$). A similar approach is used for education where information from SEC2A (Education $_{sec2a}$) was added to information from SEC9A (Education $_{sec9a}$).

2.3 District level price

The GLSS gathered household prices whenever feasible and collected community-level prices for certain commodities. However, the final household sample did not consistently align with prices from these two sources. In some instances where a match was made, the households only had prices for a limited set of commodities. Another obstacle was the lack of recorded dates for some community-level prices, making their alignment with the weekly panel tricky. Furthermore, the utility of the prices compiled at both household and community levels was limited by the measurement units used. Most commodities were recorded in local units (e.g., "PIECE", "BULB", "BALL") which are not readily convertible into standard units like kilograms and liters. This is consistent with Ghana's agricultural trading system where these local units predominate, although meats and fish are often traded in standard units. To address these pricing challenges, a multistep process was implemented, drawing upon price data from the GLSS and various national/private institutions. This process aimed to construct weekly price series for all commodities, which were then matched to each household's consumption value, focusing on the weekly data that accounted for the largest portion of their reported data.

Firstly, daily entries for all commodities recorded in the GLSS using local units were converted to standard units, following methods from previous Ghanaian studies (Zereyesus et al. 2017; Tsiboe, Zereyesus, and Osei 2016). The resulting values were aggregated into weekly prices at the EA level by taking the median across all households and community markets for each EA and week. A similar process was employed for weekly/daily price data from Ghana's Ministry of Food and Agriculture (MOFA) and ESOKO (https://esoko.com/), but at the market level. In the next step, the aggregated data was spatially projected onto a map of Ghana, using the centroid of administrative districts. The price for a specific district, week, and item was calculated as the inverse-distance-weighted mean of all the projected prices, using the district's centroid as the aggregation point. This created a series of price data for selected food items over the interview week dates. Any missing data for a particular district-food item pair was estimated through temporal extrapolation, based on the spatially interpolated series. If prices were still missing following this process, the spatial interpolation of regional monthly prices from the Ghana Statistical Services filled the gaps.

Prices for firewood, charcoal, liquefied petroleum gas (LPG), diesel, petrol, and kerosene were obtained from the price questionnaire where possible. If data was missing, monthly prices were sourced from published reports/databases. For example, national-level indicative monthly prices for petroleum products were taken from the Ghana National Petroleum Authority website. Charcoal prices came from the Energy Commission Ghana's discontinued "Charcoal Price Tracking in Major Urban Centers of Ghana" (published 2012-2014). Prices for all other non-food items were drawn from the regional monthly consumer price index for their respective index-grouping, provided by the GSS.

Finally, the price series from all sources were merged with the consumption database, matching the item code and the week date that corresponded to the household's largest recorded consumption value.

2.4 Food quantity and nutrient

The quantity (kilogram or litters) of each food item is calculated as the outcome of dividing the value of consumption by their respective prices. Food densities retrieved from Charrondiere et al. (2012) were then utilized to convert the food quantities in liters (i.e., oils) to kilograms. The estimated kilogram of each food item was converted to micro and major nutrients using a food composition table retrieved from Stadlmayr et al. (2012). For food items that did not have any known conversion factors from Stadlmayr et al. (2012), the nutrients content was imputed by using median conversion factors amongst all the food items in their respective food groups with known conversion factors from Stadlmayr et al. (2012).

3. Data Description

After harmonizing the data, outliers are determined and removed as those observations with total expenditure or total metabolizable energy above the 2.5th and below the 97.5th percentile by survey and region. The final sample consists of 35,867 households whose members represent the consumption of about 24.67 million Ghanaians (i.e., about 85% of Ghana's population) as of 2017. Each household has one observed consumption record for 51 food and non-food consumption items.

Table 1 provides the descriptive statistics of the households in the sample where arithmetic means are used to describe the harmonized data over the entire period captured by the raw datasets. Linear and probit regressions are used to analyze the trend in continuous and dummy variables, respectively.

Table 1 shows that the households in the final sample averaged about 4.35 members in adult equivalence (AE), with a dependency ratio estimated at 1.33. Over the forgoing period [2005 to 2017], the size of the household significantly ($p<0.05$) decreased annually by about 0.17%. The aggregated characteristics of the decider, shown in Table 1, indicates that for a typical household, there is a 0.55 probability that the decider is a female and a 0.68 probability that it is the household head. The average age and years of education of the decider are 37.56 and 5.42 years/AE, respectively. The trends in the characteristics of the decider, over the span of the data, indicate that the probability of being a female and years of education have all significantly ($p<0.05$) increased annually by 0.36 and 2.63%, respectively.

From Table 1 it can also be observed that the daily consumption-based standard of living measure of the household is estimated at GHC 7.42/AE. Applying the appropriate poverty lines - set at the minimum consumption requirement - indicates that 10, 13, and 77% of the households in the sample are classified as very poor, poor, and non-poor, respectively. Over the forgoing period, with a 51.28% annual increase in the standard of living measure, it can be observed that the probability of observing a very-poor household significantly ($p<0.05$) declined by 0.67% annually. The probability of observing a non-poor household significantly ($p<0.05$) increased by 0.24%. These movements of households out of poverty reflect Ghana's rapid national development in terms of real economic growth averaging about 7% annually between 2007 and 2016 (Ghana Statistical Service [GSS] 2017) and meeting its Millennium Development Goal's targets (FAO, IFAD and WFP 2015).

In terms of access to assets, Table 1 also shows that 61, 88, 26, and 9% of the households had access to radios, phones, bicycles, and motorbikes, respectively. Location-wise, Table 1 shows that 57% of the sample are in rural areas, however, the trend for the rural variable is negative and significant ($p<0.05$), indicating the migration from rural to urban areas. Finally, Table 1 shows that majority of the sample is situated in the Forest ecology of Ghana, the Savannah follows next, and

then the Coastal zone. The grouping of the households into the location and poverty categories do overlap to an appreciable extent. For instance, the very poor are more likely to be in rural areas and the Savannah ecology, while the Savannah ecology is more likely to be rural.

Table 2 shows that weekly household expenditure on food is about GHC 38/AE, representing about 48% of the household's total weekly expenditures. Comparing this expenditure over the forgoing period indicates that household weekly food expenditure significantly increased by about 287% from 2005 to 2013, and 429% from 2013 to 2017. Table 2 also indicates significant differences in the weekly household expenditure on food across household groupings. Particularly; (1) households in Forest and Savannah ecologies have food expenditures that are 8 and 32% lower than their peers in the Coastal ecology; (2) rural households spend about 22% less on food than urban households; and (3) the poor and very-poor households spend at least 49% less on than the non-poor. The mean weekly expenditure of fuels and non-food items was estimated at GHC 3/AE and GHC 39/AE, respectively, and their variations across time and the various household groupings follow that of food. On average, about 22.9% of the household's weekly food budget is allocated to cereal, followed by roots/tubers/plantain (16.6%), vegetable (12.8 %), meat (9.8%), fish (8.2%), oil (5.1%), legume (4.1%), fruit (3.3%), dairy (1.9%), eggs (1.4%), and then nuts (1.3%).

Table 3 describes the contribution of major food groups to the nutritional availability within Ghanaian households from 2005 to 2017. The statistics highlight the transition of nutritional intake over this period. First, cereals make the most significant contribution to metabolizable energy, carbohydrates, protein, and fiber intake in Ghanaian households. This is understandable given that cereals such as maize, rice, and millet are staple foods in Ghana, providing the bulk of energy and macronutrients to the diet. The data is consistent with the broader theme of a nutrition transition, where societies initially reliant on a single staple crop (like cereals) gradually incorporate a more diverse array of foods. Next, roots, tubers, and plantains also make a substantial contribution, particularly to the availability of carbohydrates and fiber. This reaffirms their role as a primary source of energy for many households. Interestingly, their contribution to protein availability is considerably lower, suggesting that Ghanaian households are getting most of their protein from other food groups, primarily cereals. Legumes are another significant food group, contributing notably to fat and protein availability. This finding is in line with the nutrient profile of legumes, which are rich in both protein and fat, and shows the increasing importance of this food group in the Ghanaian diet. Vegetables, although contributing less to metabolizable energy compared to cereals, roots, and legumes, still offer a meaningful share of fiber and protein. This illustrates the role of vegetables not just in providing essential vitamins and minerals, but also contributing to the macronutrient composition of the diet. Oil, fish, nuts, fruit, meat, eggs, and dairy contribute less to the overall nutrient availability, compared to cereals and roots/tubers. However, oil stands out for its high contribution to fat availability, despite its smaller overall contribution to the diet. This reflects the high caloric density of oils.

Table 4 illustrates the changes in nutrient availability for Ghanaian households between 2005 and 2017. It includes major nutrients such as metabolizable energy (kcal), carbohydrates, fats, proteins, and fiber. The values are represented in terms of both mean consumption and percentage variations across time, geographical locations (Coastal, Forest, Savannah), residential type (Rural), and poverty status (Poor, Very Poor). The data shows a significant increase in the availability of all major nutrients from 2005 to 2017. The greatest increase is noted in 2016/17, where metabolizable energy, carbohydrates, and fats show an increase of 498.34%, 461.56%, and 311.99% respectively,

from the 2005/06 baseline. Protein availability also massively increases, with a rise of 1330.38%. Fiber availability follows the same pattern, with a notable increase of 992.68%.

These changes are likely influenced by various factors, including rising incomes, urbanization, and changes in food production and supply chains, reflecting the broader nutrition transition previously discussed. The Savannah region shows a significantly higher nutrient availability compared to the Coastal and Forest regions, likely indicating differences in dietary patterns and food access across these regions. This highlights the role of local food environments and agricultural practices in shaping nutrient intake. Rural households also demonstrate a higher nutrient availability compared to their urban counterparts. It could be due to their proximity to food production areas, allowing for more direct access to fresh produce. However, this might also reflect a reliance on more energy-dense, carbohydrate-rich diets characteristic of rural settings, particularly among low-income households. The data reveals that poorer households, while having lower overall nutrient availability than non-poor households, have seen significant increases in nutrient availability over the study period. This could be due to various factors, including social protection programs, improvements in agricultural productivity, and increased food access. However, the fact that nutrient availability is still lower for these households compared to non-poor households underlines the persistent challenges of food security and nutrition inequity.

4. Concluding remarks

Comprehending food consumption patterns, nutrient availability, and overall household expenditures is paramount for developing efficacious policies designed to alleviate poverty, hunger, and health issues. The data collected are invaluable for steering initiatives aimed at enhancing the overall well-being. Nevertheless, the usefulness of such data hinges on the richness, scope, and reliability of the information collated. The Ghana Living Standards Surveys (GLSS) provides such data, yet the Ghana Statistical Service (GSS) and prevailing academic studies have predominantly evaluated food consumption in monetary terms, thus neglecting vital facets of food consumption patterns and nutrient availability and their correlation with health outcomes. This study seeks to rectify these oversights by introducing a synchronized, nationally representative dataset drawn from the GLSS conducted in 2005/06, 2012/13, and 2016/17.

The data unearths evolving dietary patterns in Ghana, where traditional staples such as cereals continue to have a significant presence but are progressively complemented by a varied spectrum of other food groups. This aligns with the nutrition transition paradigm, a process marking the broadening of diets and the integration of an expanded assortment of foods as income brackets escalate and food environments alter. Simultaneously, this data further emphasizes the continuous progression of this nutrition transition in Ghana, distinguished by a conspicuous enhancement in nutrient availability over time. However, it underscores the urgent requirement for uniquely designed interventions to address the regional and socioeconomic differences in nutrient access and intake. The velocity of this transition, coupled with its implications for Ghana's public health, warrants further in-depth investigation and analysis.

The interpretations and discourse put forth in this study do possess certain reservations. Specifically, the analysis did not thoroughly consider the impact of auxiliary variables that could potentially distort the averages and trends. Employing a multivariate approach that accounts for these other variables is indispensable for generating accurate estimates. While this goes beyond the purview of this study, it paves the way for future research to undertake this task.

The microdata emerging from this study is constantly evolving as the most recent information is used to refine the data generation process. The vastness of the item-specific weekly data exceeds the capacity of freely available data hosting services at the time of this paper's composition. A condensed version of the data, focused on major food nutrients and disaggregated by food groups at the household level, can be accessed at https://github.com/ftsiboe/Household-Consumption-expenditure-Ghana. The data is collapsed to the survey year level by averaging the weekly values, resulting in one record per household. Researchers seeking a more intricate analysis beyond the offered data can directly reach out to the author.

At present, the non-consumption variables included with the data are solely informed by the authors' research interests at the time of this paper's writing. The data can be cross-referenced with other sections of the GLSS for an econometric analysis of food and nonfood consumption as they relate to other socioeconomic outcomes. For researchers interested in this, the raw data's identification variables are preserved, allowing any data generated from the GLSS to be linked to this data using survey [Survey], enumeration area [EaId], and household [HhId] identifiers. The only alterations made are the renaming of the original variables to facilitate harmonization across GLSSs.

5. Studies that have used/using this data include

1. Tsiboe F., Xia T., & Amanor-Boadu V. An Everyday Item or A Centerpiece of Festive Meals? Un-tying the Demand for Live and Frozen Chicken Meat in Ghana.

2. Tsiboe, F., R. Armah, Y.A. Zereyesus, and S.K. Annim. 2023. "Food poverty assessment in Ghana: A closer look at the spatial and temporal dimensions of poverty." Scientific African 19:e01518. Available at: https://linkinghub.elsevier.com/retrieve/pii/S2468227622004227. (Tsiboe et al. 2023)
3. Rural Off-Farm Employment Opportunities Improves Nutrition, But Some Are More Effective Than Others.

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Tables and Figures

Table 1: Characteristics of Ghanaian households (2005-2017)

Variable	Mean (SD)	Trend (%) [a]
Household		
Size (AE)	4.35 (2.79)	-0.17* [0.07]
Dependency (ratio)	1.33 (1.75)	-0.16 [0.16]
Decision-makers		
Female (ratio)	0.55 (0.33)	0.36* [0.07]
Head (ratio)	0.68 (0.25)	-0.08* [0.04]
Age (year/AE)	37.56 (15.30)	0.08 [0.05]
Education (year/AE)	5.42 (4.58)	2.63* [0.12]
Employed (ratio)	0.85 (0.29)	1.39* [0.05]
Poverty		
Standard of living (GHC/AE/day)	7.42 (7.94)	51.28* [5.93]
Non-poor (dummy)	0.77 (0.42)	0.24* [0.05]
Poor (dummy)	0.13 (0.34)	0.51* [0.04]
Very poor (dummy)	0.10 (0.30)	-0.67* [0.03]
Access to assets (dummy)		
Radio	0.61 (0.49)	-1.90* [0.06]
Phone	0.88 (0.32)	1.89* [0.03]
Bicycle	0.26 (0.44)	-0.78* [0.05]
Motorbike	0.09 (0.28)	0.71* [0.04]
Religion (dummy)		
None	0.03 (0.18)	-0.09* [0.02]
Christian	0.72 (0.45)	0.72* [0.05]
Islam	0.18 (0.39)	0.07 [0.04]
Traditional	0.06 (0.24)	-0.62* [0.03]
Ethnicity (dummy)		
Akan	0.41 (0.49)	-0.08 [0.04]
Ewe	0.13 (0.33)	0.06 [0.03]
Ga-Dangme	0.07 (0.25)	-0.09* [0.03]
Guan	0.04 (0.20)	-0.01 [0.02]
Gurma	0.07 (0.26)	-0.35* [0.03]
Gursi	0.03 (0.18)	-0.07* [0.02]
Mande	0.01 (0.11)	0.00 [0.01]
Mole-Dagbani	0.19 (0.40)	0.93* [0.04]
Non-Ghana	0.01 (0.09)	0.10* [0.02]
Other	0.03 (0.17)	-0.14* [0.02]
Location (dummy)		
Rural	0.57 (0.50)	-0.52* [0.05]
Coastal ecology	0.25 (0.44)	-
Forest ecology	0.41 (0.49)	-
Savannah ecology	0.34 (0.47)	-

* Indicates statistical significance at $p<0.05$

Number of households: 35,867

[a] Estimated via a linear regression for continuous variables and probit model for dummies. A fixed effect for the region and a trend variable, as well as their interactions, were included in the estimation. The trend in each variable was then taken as the marginal effect for the trend variable.

Sources: Author's estimation from the Ghana Living Standards Surveys [2005/06, 2012/13, 2016/17]

Table 2: Consumption value and distribution of own production and purchased items by Ghanaian households (2005-2017)

Variable	Mean (SD)	Variation (%) [a]						
		Period (base =2005/06)		Regional (base=Coastal)		Rural	Poverty (base=non-poor)	
		2012/13	2016/17	Forest	Savannah		Poor	V. Poor
Expenditure (GHC/AE/Week)								
Food	38.01 (34.80)	286.77* [13.28]	428.85* [18.06]	-7.65* [0.99]	-32.12* [0.90]	-22.47* [0.74]	-49.00* [1.12]	-68.61* [1.24]
Fuel	2.64 (7.78)	175.39* [28.56]	380.46* [48.85]	-37.17* [2.16]	-44.62* [2.21]	-51.75* [1.65]	-71.60* [3.51]	-87.36* [3.92]
Other Non-food	38.82 (224.98)	269.84* [96.50]	518.31* [159.65]	-33.96* [4.19]	-56.25* [3.96]	-57.09* [3.04]	-44.87* [7.42]	-83.27* [8.14]
Food budget share (%)								
Cereal	22.89 (15.36)	2.45* [0.97]	5.05* [1.02]	-8.51* [0.91]	56.97* [1.35]	24.27* [0.92]	34.11* [1.19]	85.42* [1.41]
Starchy	16.63 (14.51)	-8.89* [1.05]	-10.53* [1.08]	52.31* [1.78]	-9.69* [1.30]	33.05* [1.31]	1.57 [1.33]	-31.70* [1.42]
Vegetable	12.84 (8.52)	11.80* [1.06]	6.38* [1.06]	1.17 [0.95]	20.38* [1.10]	19.31* [0.87]	18.87* [1.12]	21.77* [1.24]
Unclassified	12.68 (12.67)	5.69* [1.59]	26.07* [1.85]	-16.53* [0.94]	-40.61* [0.86]	-42.81* [0.61]	-35.71* [1.34]	-50.18* [1.47]
Meat	9.76 (11.62)	-5.88* [1.53]	-2.12 [1.63]	10.65* [1.78]	1.83 [1.75]	-13.59* [1.08]	-20.94* [1.69]	-40.52* [1.85]
Fish	8.19 (6.18)	6.98* [1.16]	9.04* [1.21]	3.20* [0.90]	-33.02* [0.76]	0.49 [0.81]	-0.47 [1.16]	-21.17* [1.26]
Oil	5.13 (5.12)	-8.82* [1.13]	-24.65* [1.07]	-11.46* [1.13]	-11.77* [1.18]	-9.23* [0.96]	-2.70 [1.55]	-12.75* [1.69]
Legume	4.07 (6.95)	-1.70 [2.30]	-1.58 [2.39]	-5.70 [3.88]	284.32* [12.45]	114.78* [5.17]	90.47* [4.04]	202.71* [5.33]
Fruit	3.27 (5.23)	4.79* [2.14]	-21.33* [1.89]	-33.09* [1.05]	-70.27* [0.93]	-53.47* [0.86]	-54.67* [1.97]	-78.00* [2.18]
Dairy	1.85 (3.21)	-9.09* [1.96]	-25.04* [1.85]	-30.82* [1.30]	-54.40* [1.21]	-57.58* [0.88]	-59.22* [2.14]	-72.84* [2.38]
Eggs	1.37 (2.62)	-0.92 [2.49]	-13.44* [2.39]	-27.58* [1.33]	-73.83* [1.13]	-55.01* [1.01]	-58.05* [2.35]	-81.13* [2.60]
Nut	1.32 (2.86)	-20.14* [2.12]	-29.15* [2.10]	-26.81* [1.49]	-78.50* [1.24]	-19.46* [1.84]	-33.95* [2.89]	-70.42* [3.15]

* Indicates statistical significance at $p<0.05$

Number of households: 35,867

[a] Estimated via a linear regression

Sources: Author's estimation from the Ghana Living Standards Surveys [2005/06, 2012/13, 2016/2017]

Table 3: Contribution of major food groups to major food nutrient availability amongst Ghanaian households from 2005-2017 (%)

	Metabolizable energy	Carbohydrate	Fat	Protein	Fiber
Cereal	27.670 (18.125)	36.662 (26.769)	46.137 (31.625)	14.898 (19.636)	34.896 (26.403)
Roots/tubers/plantain	19.204 (17.506)	25.125 (23.912)	33.626 (27.983)	4.412 (8.951)	11.787 (14.523)
Legume	3.508 (6.854)	13.873 (25.310)	8.391 (21.745)	22.163 (30.961)	18.092 (27.767)
Vegetable	15.957 (9.890)	8.900 (16.033)	9.346 (16.777)	5.778 (12.077)	12.856 (20.251)
Oil	4.399 (4.607)	8.192 (10.301)	0.000 (0.000)	33.750 (28.717)	0.000 (0.000)
Fish	13.063 (9.842)	1.861 (3.414)	0.000 (0.000)	5.294 (8.831)	11.179 (11.336)
Nut	0.753 (2.058)	1.462 (4.111)	0.286 (1.272)	5.630 (12.973)	0.299 (1.143)
Fruit	3.557 (7.547)	1.375 (4.395)	1.869 (5.622)	0.640 (3.589)	0.825 (3.161)
Meat	8.156 (10.337)	1.178 (2.738)	0.000 (0.000)	3.156 (6.877)	6.060 (9.448)
Eggs	1.393 (3.233)	1.083 (3.897)	0.058 (1.133)	3.933 (10.667)	3.119 (7.577)
Dairy	2.340 (5.074)	0.288 (1.970)	0.253 (1.948)	0.346 (2.748)	0.883 (3.742)

* Indicates statistical significance at $p<0.05$

Number of households: 35,867

[a] Estimated via a linear regression

Sources: Author's estimation from the Ghana Living Standards Surveys [2005/06, 2012/13, 2016/2017]

Table 4: Major food nutrient availability in Ghanaian households (2005-2017)

	Metabolizable energy (kcal/AE/Week)	Carbohydrate (kg/AE/Week)	Fat (kg/AE/Week)	Protein (kg/AE/Week)	Fiber (kg/AE/Week)
Mean (SD)	48283.38 (42548.84)	5177.91 (4368.11)	2468.45 (3334.22)	836.14 (784.61)	451.99 (408.88)
Variation (%) [a]					
Period (base =2005/06)					
2012/13	-6.91* [1.02]	0.98 [1.11]	-17.47* [1.30]	17.48* [1.76]	-1.20 [1.15]
2016/17	-24.37* [0.95]	-15.91* [1.03]	-38.88* [1.19]	44.06* [2.10]	-16.86* [1.09]
Regional (base=Coastal)					
Forest	-18.17* [0.87]	-8.39* [0.97]	-26.93* [1.15]	-10.06* [1.12]	-3.92* [1.25]
Savannah	-26.69* [0.87]	-16.80* [0.96]	-37.72* [1.14]	-2.58* [1.22]	25.82* [1.54]
Rural	-20.16* [0.73]	-8.80* [0.81]	-30.38* [0.99]	-10.82* [0.88]	14.53* [1.13]
Poverty (base=non-poor)					
Poor	-47.72* [1.11]	-42.44* [1.09]	-53.71* [1.70]	-40.65* [1.24]	-27.51* [1.28]
V. Poor	-56.91* [1.23]	-51.21* [1.21]	-64.01* [1.89]	-45.09* [1.38]	-27.97* [1.42]

* Indicates statistical significance at $p<0.05$

Number of households: 35,867

[a] Estimated via a linear regression

Sources: Author's estimation from the Ghana Living Standards Surveys [2005/06, 2012/13, 2016/2017]